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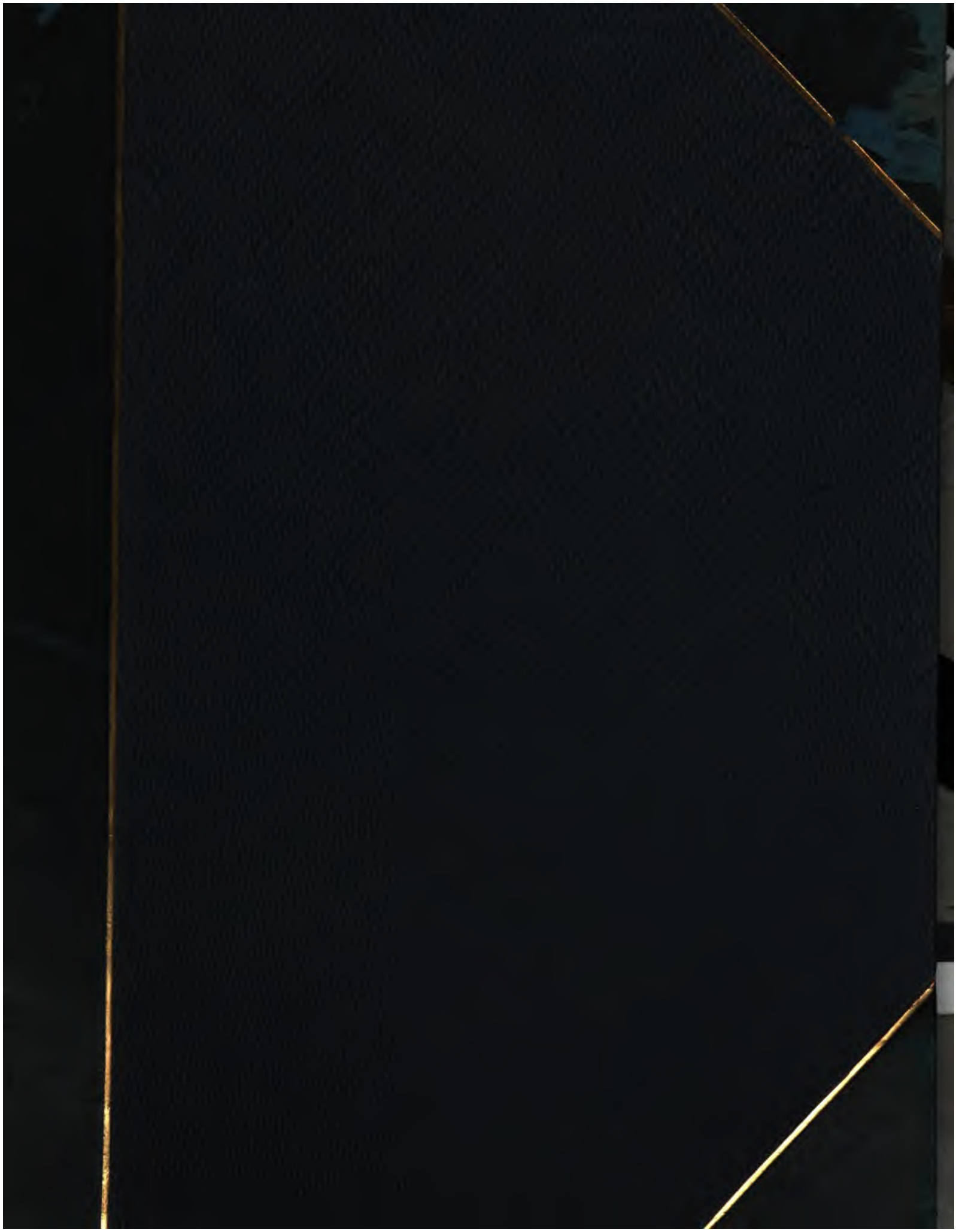
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SUPPLEMENT

TO

A MONOGRAPH

OF THE

BRITISH FOSSIL TRIGONIÆ.

BY THE LATE

JOHN LYCETT, L.R.C.P.E., &c.

LONDON:

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SUPPLEMENT TO THE MONOGRAPH

OF THE

BRITISH FOSSIL TRIGONIÆ.

The discovery of two species of *Trigonia* in the Lower Lias of Oviedo, Northern Spain, is an important fact in Palæontology, as it carries back the genus in Geological time almost to the Trias, and therefore nearly to the position of its allied genus and precursor, *Myophoria*. Previously, the oldest recorded species of *Trigonia* of which we have any certain knowledge was the *Trigonia Lingonensis*, Dum., obtained in the upper portion of the Middle Lias of France and England.[1] The Spanish *Trigoniæ* now described were obtained by Dr. Charles Barrois, of the Faculté des Sciences, Lille, and are stated by him to occur on the border of the Liassic basin of Oviedo, overlying Trias. I have previously, at page 211 of my 'Monograph on Trigoniæ,' mentioned my obligations to Dr. Barrois for his important contributions of Belgian Trigoniæ to that work, and have now again to express my thanks and recognition of the high value of his present contribution. Dr. Barrois refers these *Trigoniæ* to the *Angulatus zone* of the Lower Lias, and mentions that he has transferred his Jurassic fossils to his friend, Mons. A. Six, of Lille (Secretary to the Northern Geological Society), who is actively engaged in the study of the Jurassic rocks of Eastern France. A subsequent communication obligingly contributed by the latter gentleman, contains much additional information respecting these Spanish *Trigoniæ*, and informs me that the fossils associated with them are in bad preservation, that some of them are new, that there are no Cephalopoda with them, and that he has ascertained the following species of Lamellibranchiata, *Cardinia concinna*, Sow., *Astarte detrita*, Goldf., *Protocardia Phillipiana*, Dunker., *Protocardia truncata*, Sow., also a gigantic *Gervillia*, upwards of eleven centimètres in length. These fossils he assigns to the Etage Hettangien or Infra Lias of Turquem and Pictte. The *Trigoniæ* were associated with the gigantic *Gervillia*, the position of which he believes to be the upper portion of the *Angulatus zone*; carbonaceous masses also occur. The lithological aspect of the *Trigoniæ* resembles that of the fossils generally from the Lower Lias shale; they are all separated valves. These are the oldest examples of *Trigoniæ* of which we have any certain knowledge.

[1] 'British Trigoniæ,' p. 98, also pp. 219.

TRIGONIA OVIEDENSIS, *Lycett.* Sp. nov. Woodcuts, figs. 1 and 2, nat. size.

Shell ovately oblong, somewhat Unio-like, moderately convex anteally and mesially, more depressed posteriorly; umbones not very large or prominent, but pointed, and situated within the anterior third of the valve; the ornamented or costated portion of the surface occupies about three-fourths of the valve; the costæ are very numerous, very closely arranged, not prominent, for the most part closely and imperfectly tuberculated; the tubercles are depressed and often obscure; the general direction of the rows is horizontal, those occupying the first four lines in height adjacent to the apex are linear and nearly smooth; their arrangement is so close that about twenty-five may be counted; the costæ of the other and greater portion of the valve, about twenty-five in number, are tuberculated and horizontal; the rows become somewhat more prominent at

FIG. 1. FIG. 2.



Trigonia Oviedensis, from Spain.

their posteal extremities, where they terminate abruptly at the smooth ante-carinal space; they are sometimes undulated, but all have a general horizontal direction. The smaller or smooth portion of the shell, represents a narrow ante-carinal space, a narrow smooth area with obscure bounding carinæ, and a narrow, lengthened escutcheon; the latter is about half the length of the entire valve; the area has also a slightly defined mesial furrow. The specimens contributed by Dr. Barrois differ among themselves in the prominence of the subtuberculated costæ, but the general figure of the shell is nearly alike though essentially different from its allied congeners of the *glabræ*, from which it it is separated by the ovately oblong figure, by the small umbones and by their anteal position.

In the character of the ornamentation in *T. Oviedensis* there is a remarkable fact, inasmuch as it is nearly allied to a species of the same section (*Glabræ*) placed almost at the opposite extremity of the Jurassic species, viz. the *T. tenuitexta*, Lyc., of the Portland formation;[1] but in the general figure the two species are strikingly different; in fact the shape is the feature by which *T. Oviedensis* is most conspicuously distinguished, and which at once separates it from the Portlandian *Glabræ*.

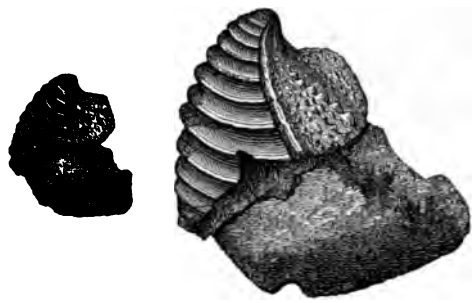
[1] Monograph, p. 90.

Dimensions.—Length of the specimen in Fig. 1 21 lines; height 16 lines; convexity of a single valve 5 lines. Fig. 2, a more imperfect specimen, has the ornamentation more strongly defined. A third example retains little more than the ornamented portion of the surface; a fourth specimen is smaller and nearly entire in outline, but retains little more of the surface than the irregular lines of growth.

TRIGONIA INFRA-COSTATA, *Lycett.* Sp. nov., figs. 3 and 4. (Fig. 4 enlarged one diameter.)

Of this small species of the *Costatæ*, I have only a single imperfect example, fortunately the portion preserved possesses all the features necessary to characterise the species; it is remarkable for the unusual prominence of the ornamentation upon the escutcheon and the area, and more especially for the great breadth of the escutcheon; the costæ (of which about seventeen are preserved) are narrow, very prominent, and

FIG. 3. FIG. 4.



Trigonia infra-costata, from Spain.

much marked transversely by decussating lines of growth which indent their surfaces, rendering them slightly nodulous; their posteal extremities are well separated from the marginal carina, which is large, and has its tubercles unusually prominent; the inner and median carinæ are well-defined; there are also some small inter-carinal costellæ. The escutcheon is very wide and flattened, its large irregular tubercles give to it a roughened nodose aspect. The umbones are narrow, prominent, and recurved. The anterior side is somewhat compressed and sinuated. Apparently, the shell if perfect would have more than twice the height of the portion preserved. It was associated with *T. Oviedensis*, and appears to be more rare than that species.

By referring to the comparison of the genus *Myophoria* with the *Costatæ* at p. 215 of this Monograph, the above description of the present species will show that both by its figure and surface ornaments it is clearly separated from *Myophoria*, and that it possesses all the attributes of the *Trigoniæ costatæ*, even more strongly developed than is usual with that section. The curvature of the umbones is more especially well marked, and would alone suffice to establish its generic identity.

APPENDIX.[1]

During the latter period of the publication of my Monograph on the British Fossil Trigoniæ and subsequently, the fossils of the Inferior Oolite of Oxfordshire were brought very fully under my notice; these were found to contain three new species of *Trigoniæ*, *T. Guisei*, *Walfordi*, and *Windoesi*, four varieties of *T. signata*, Ag., which I have here named at pages 5—10, *Zietenii*, *rugulosa*, *Stutterdi*, and *decurtata*. Three of the varieties, viz. *rugulosa*, *Stutterdi*, and *decurtata*, appear to be unknown at other British localities. These discoveries have resulted from the labours of several local investigators. The fine collection of Oxfordian fossils made by Mr. Stutterd, of Banbury, and now placed in the Oxford University Museum, has stimulated, as might be expected, the exertions of other observers; of these may be mentioned Mr. E. A. Walford, F.G.S., of Banbury, and Mr. J. Windoes, of Chipping Norton, who, for several years past, have been ardent searchers of Oxfordshire Inferior-Oolite fossils. Owing to their kind consideration I have had the advantage of comparing their cabinets with those of my old friend Mr. Witchell, of Stroud, who has so long worked in the same formations in the Cotteswolds, more especially in the higher beds in the vicinity of Stroud. The results are novel and interesting, and are embodied in the descriptions of the figures in Plates I—IV of this Supplement. In addition I am enabled to illustrate a previously undescribed, but well-marked Inferior-Oolite variety of a recognised Great-Oolite species, as well as a variety of a foreign Lower-Oolite species hitherto unknown in Britain (if not a new species itself). Also further illustrations of three Inferior-Oolite species, and one from the Lias.

Trigonia signata, *Ag.*, *var.* Zietenii. Trigon. Supplement, Plate I, figs. 3, 4, 5, 16, 17, and Plate IV, fig. 7.

Trigonia signata is illustrated in the previous portion of this Monograph (page 29, Plate II, figs. 1, 2, 3) by three specimens, two of which are from the Cotteswold Hills, the other from the north-eastern coast of Yorkshire; they all exemplify a single variety, for which I propose the name *Zietenii*. In Yorkshire this Trigonia is the sole variety

[1] The manuscript of the Appendix did not come into the possession of the Palæontographical Society until some time after the lamented author's death. The explanations of the plates, and the localities have been revised by Mr. E. A. Walford, F.G.S.

known; it is rare, and is unlike the usual forms attributed to *T. signata*. In Yorkshire *T. signata*, var. *Zietenii*, is remarkable for a general regularity and uniformity of aspect, both as regards the figure of the shell and the surface ornaments; the costæ and the tubercles are slightly developed, so that usually the tubercles are distinct only near the middle of the valve, and the costæ become small or string-like, and disappear or are attenuated as they approach the pallial border. This variety occurs rarely, near Scarborough, at Cloughton, in the zone with *Ammonites Blagdeni*, *A. Braikenridgii*, and *A. Humphriesianus*.

In the South of England, in the Cotteswolds, *T. signata*, var. *Zietenii*, is known only in a higher position, or zone of *Ammonites Parkinsoni*, where it is also a rare species, but has a greater diversity of aspect in the figure of the shell, in its costæ, in its tubercles, and in the ornamentation of its area; the costæ are sometimes malformed or broken and irregular; the tubercles vary much in size and prominence; the carinæ may be either prominent, or faintly defined; and the transverse plications upon the area are either fine and delicate, or coarse and irregularly disposed. In the Cotteswolds the tubercles upon the costæ are comparatively large, and continue rounded even to the pallial border; the area has its ornamentation almost evanescent both in its carinæ and in its transverse plications, becoming almost steep and narrow, and the shell acquires greater convexity. The Oxfordshire variety *Zietenii* is generally and constantly smaller than that of the Cotteswolds and somewhat more lengthened posteally; the costæ are equally numerous, but have the tubercles smaller and numerous, which imparts a neater aspect to the shell; the individual peculiarities are also less conspicuous and rarely exceed those exhibited in the forms on Suppl., Pl. I, figs. 4 and 5, which have been selected to exhibit malformations of the rows of costæ upon the middle of the valves; but the differences of ornamentation upon the area are comparatively trifling.

The bed of white limestone (Upper Trigonia-grit) is the only stratum which has produced *T. signata* in the Cotteswolds. My experience of twenty-two years' residence in that district, together with frequent subsequent comparisons of its fossils, induce me to regard the Upper Trigonia-grit as affording specimens greatly inferior to those of the sandy limestones of Oxfordshire. The condition of preservation of the more minute and delicate features is usually less satisfactory. These remarks will more especially apply to the present variety, a typical shell of the Inferior Oolite, everywhere rare, but especially so in the Cotteswolds, where not more than one or two really fine specimens can be expected to fall to the lot of any collector, however extended in time may be his search for them. Even in Oxfordshire, where the species has occurred in greater numbers in the sands and sandy limestones of Hook Norton and Rollright Heath, it has of late years become somewhat rare. Mr. Stutterd, of Banbury, was fortunate enough to collect numerous fine specimens which now adorn the University Museum, Oxford, a success which has not subsequently been rivalled by any other person, and the species is no longer common.

In Oxfordshire, at Hook Norton[1] and Rollright Heath, which have produced this species less rarely, these varietal features are more strongly developed, and specimens have greater differences of aspect. For a better knowledge of these, and for the comparison of instructive illustrative specimens, I am much indebted to Mr. E. A. Walford, of Banbury, who forwarded to me his collection from the Inferior Oolite of Oxfordshire, together with that of another industrious collector, Mr. J. Windoes, of Chipping Norton, in the same County. The notes which Mr. Walford has supplied to me describing the strata of Hook Norton and their fossil contents evince discriminative ability and minute observation; they entitle him to my sincere thanks.

The description of *Trigonia signata*, Ag., var. *Zietenii*, given at page 29, is sufficient to render further remarks unnecessary; they may, however, be supplemented by the note upon *Trigonia ingens*, page 207, comparing the latter with the Inferior-Oolite shell. So considerable is the zoological affinity between these two forms that I have seen experienced observers take up the Neocomian form in the full belief that they were handling the shell of the Inferior Oolite. No doubt the distinctive differences indicated at page 207 are constant and reliable; but these are of such small importance in a zoological point of view, that it is difficult to escape the conviction that in the Inferior-Oolite shell *Trigonia signata*, var. *Zietenii*, we see the precursor or progenitor of the Neocomian *T. ingens*, however great may be the stratigraphical hiatus separating the two forms. I have therefore deemed it desirable to figure two of the Oxfordshire forms which exhibit variations in the surface ornaments, and also one additional Yorkshire example which has none of these individual peculiarities. Trigon. Suppl., Plate I, figs. 16, 17, represent two little immature forms which appear to be examples of the same variety in a very young state; one of these (fig. 17) is from the Upper Trigonia-grit of Rodborough Hill, supplied by my friend Mr. Witchell; the other (fig. 16), of nearly similar dimensions, was collected by Mr. Windoes in one of the lower beds of the formation in Oxfordshire; these two specimens have a distinct plain marginal carina and tuberculated inner carina even as far as the apex, the costæ then become slightly tuberculated at the third row, and the general ornamentation of the valve is thence established.

The Oxfordshire collections forwarded to me by Mr. Stutterd, by Mr. Walford, and Mr. Windoes, are also especially interesting, as they exhibit three other well-marked

[1] The following general section of the strata at Hook Norton has been supplied to me by Mr. E. A. Walford:

		Feet.	Inches.
	Upper Lias *Leda ovum* beds (at bottom) . . .	—	—
A.	Sand and blue hearted limestone	2	3
B.	Flaggy limestone, very sandy	1	6
C.	Limestone courses, divided by sand	4	8
D.	Sands, clays, and thin courses of limestone, with plant remains .	17	0
E.	Sand with oysters, pectens, bored limestone, and sandy whitish limestone (Rollright Grits).	6	0

varieties of *Trigonia signata*, which are herewith figured, and named as varieties, and described. These, it will be observed, occur only at a lower position in the Inferior Oolite, apparently in the zone of *Ammonites Murchisoni;* they seem not to be known beyond the limits of Oxfordshire, unless possibly the variety *rugulosa* may be identical with the figure of *T. clavellata*, Quenstedt, 'Jura,' tab. 60, fig. 13, from the Brown Jura of Swabia.

At page 221 are remarks upon the abundance and variety of the CLAVELLATÆ in the Middle and Upper Jurassic Rocks, and of their sudden disappearance thereafter. We might naturally expect to find the progenitors of these forms, so numerous and varied, in some of the older beds containing Trigoniæ; it is my present belief and impression that in the Inferior Oolite of Oxfordshire we have the precursors of at least two of the more abundant of the later forms, and that the variety under notice should be placed zoologically as an analogue of *T. ingens* of the Neocomian Rocks.

TRIGONIA SIGNATA, *Ag.*, var. RUGULOSA, *Lycett.* Trigon. Supplement, Plate II, figs. 1, 2, 3; Plate IV, figs. 2, 4.

Dimensions equal to the more common variety *T. signata*, var. *Zietenii*, but the test is thicker and more ponderous; the convexity is more considerable, the area narrow, steep, and slightly expanded, the hinge-border is comparatively short and depressed, the siphonal border oblique, forming only a small angle with the hinge-border; the lower termination of the siphonal border is produced and pointed; the area altogether is extremely rugose, especially its bounding carinæ; its transverse costellæ, where they are distinct, form a double curvature when well defined, and are depressed in the middle by the median furrow; the lower third of the area has the plications large, oblique, rugose, and irregular. The rows of costæ (about 15) are large with much upward curvature posteriorly, the tubercles in the rows are for the most part closely placed and are larger than in var. *Zietenii;* they become partially cord-like, but are large and very unequal even to the pallial border; the first-formed two or three rows of costæ are quite plain, as in the other varieties. The rugose aspect of the whole shell is very striking and remarkable.

An unusually fine specimen with the valves open, now in the Geological Survey Museum, London, exhibits the peculiarities of this variety in a very conspicuous manner; it was worked out by myself about thirty years ago, and was known to have been obtained in the vicinity of Chipping Norton. It is alluded to in the Monograph, page 30, and would have been figured had not its geological position at that time remained doubtful; it is, indeed, only very recently that the exact position of this variety has become known, the three specimens herewith figured, Plate II, figs. 1, 2, 3, collected by Mr. Walford and Mr. Windoes, and the two by Mr. Stutterd, Plate IV, figs. 2, 4, amply illustrate

this remarkable variety. It is rare. The matrix of these fossils is tough and hard, and required a considerable expenditure of time, labour, and steel implements to bring these specimens to their present condition. The two larger and more perfect specimens (Pl. II, figs 1, 3) were obtained at the cross-roads near Over Norton, the others (Pl. IV, figs. 2, 4) in the lower beds of the Inferior Oolite at Rollright.

Possibly the remarkable shell figured by Quenstedt, 'Der Jura,' a Swabian species, tab. 60, fig. 13, under the name *clavellata*, should really be arranged with this variety of *T. signata*, of which it has the usual rugose aspect, more especially in the characters of the costæ, fewer in number, broken and irregular, with their cord-like tubercles extending even to the pallial border; the stratigraphical position appears also to agree with that of this variety. The hard, unyielding matrix is altogether unlike the more sandy stratum in the upper beds of the formation which have yielded the *Zietenii* variety; it may be compared rather with the Clypeus-grit of the Cotteswolds.

TRIGONIA SIGNATA, *Ag.*, *var.* STUTTERDI, *Lycett.* Trigon. Supplement, Plate II, figs. 9, 10, 11; Plate IV, figs. 1, 5, 6.

The shell, less depressed than in the former two varieties, is more sub-ovate and less lengthened; the umbones are prominent, and are more recurved and less forward; the anterior side is more produced; the hinge-border is shorter, and more distinctly concave; the area is wide and flattened, much expanded posteally; on each side it is bounded by a prominent row of large, rounded, regular carinal tubercles; the median carina is represented by an obscure row of small tubercles; the transverse plications are inconspicuous; near the apex they become linear, and are very closely arranged. The sides of the valves have more convexity than in the former varieties; the rows of costæ are much less numerous, and more widely separated; they are very regular in their arrangement, and are all curved obliquely; the few latter-formed costæ are curved upwards nearly perpendicularly, as is usual in the shells of *T. signata;* the tubercles are larger than in the other varieties, and less numerous, more especially in the latter-formed rows; they are moderately rounded, excepting near to the pallial border, where they become cord-like, but are continued even to the border. The lines of growth are remarkably large and conspicuous over the whole of the valves; the first-formed two or three rows of costæ are plain, as in the other varieties. The number of tubercles in the rows are comparatively few; the largest are about the middle of each row; they become attenuated as they curve upwards in their approach to the marginal carina.

The present variety presents an approach to the well-known *T. clavellata;* a comparison of specimens show that the Inferior-Oolite Shell has the umbones more recurved, the hinge-border shorter, and the rows of costæ with a greater curvature. The pecu-

liarity of their posteal attenuation and upward curvature, forming varices towards the carina, would of itself be always sufficient to separate the two forms; nevertheless, the approximation is such that I think we may fairly regard this variety as the precursor of the well-known species of the Middle Oolites.

The remarkably fine example of this variety contributed by Mr. Stutterd, of Banbury, and two others from my cabinet, constitute the three specimens on Plate IV. A comparison of these, and of a fourth specimen sent by Mr. Stutterd, but not figured, as well as a fifth in my cabinet, and of the three specimens from the collections of Mr. Walford and Mr. Windoes figured on Plate II, figs. 1, 2, 3,—a comparison of these with the figure of *Trigonia trigona* (Waagen, 'Beiträge, über der Zone des Am. Sowerbyi,' plate xxix, fig. 3, *a*, *b*) induces me to regard the species from Southern Germany as constituting another variety of *Trigonia signata* allied to the present Oxfordshire variety, but distinct from all known British forms.

The terminal posteal varix in each row of costæ in our variety has a considerable resemblance to Dr. Waagen's fine Trigonia, of which it constitutes a prominent feature in the ornamentation; the figure of the shell, however, and of surface ornaments constitutes a distinction.

Position and localities.—The specimens contributed by Mr. Stutterd (Pl. IV, figs. 1, 5, 6) are from the Inferior Oolite of Rollright Heath; those on Plate II, figs. 1, 2, 3, are from the Inferior Oolite of the Cross roads, near Over Norton. It is rare and appears to be one of the most variable of the Oxfordshire forms in its general aspect and ornaments.

TRIGONIA SIGNATA, *var.* DECURTATA, *Lycett.* Trigon. Supplement, Plate I, figs. 1, 2; Plate IV, fig. 3.

Shell with the general figure of *T. signata*, but less depressed and somewhat shorter posteally; umbones large and moderately recurved; hinge-border somewhat concave, sloping obliquely; area of moderate breadth, somewhat raised and flattened; transversely, closely, and minutely striated throughout its entire length; median carina very minutely papillated; the two bounding carina nearly similar in character, and not very distinctly separable from the transverse striations. The other portion of the shell has curved rows of costæ, which are less numerous than in the first two varieties, and are more irregular in their general direction and aspect.

Our description is founded upon two specimens which vary moderately from each other in the characters of their pallial costæ. In both specimens the first few rows are sub-concentric or transverse, and minutely tuberculated, and become attenuated as they approach the anterior border. The succeeding rows are for the most part obliquely curved, but with less regularity; the tubercles are small, unequal, and sometimes

imperfectly developed; the few last costæ enlarge much posteally, their tubercles become more prominent; they approach the marginal carina at a considerable angle, the last three or four rows terminating in varices, which are attenuated and not distinctly tuberculated; the larger specimen has about fifteen, the smaller one thirteen costæ; the lines of growth are moderately distinct upon both specimens.

Length of the larger specimen 29 lines; height 14 lines. The smaller specimen, which is more imperfect, has the length about 17 lines.

The smallness, inequality, and irregularity of the tubercles, together with the tendency to effacement about the middle of the valve, together with the enlargement of the costæ posteally, are the most prominent distinguishing features of this small variety, which appears to be rare, as Mr. Walford can only refer to three specimens.

Position and locality.—Hook Norton in the lower beds, limestone with courses of sand, B and C of Mr. Walford's section (page 7).

TRIGONIA PULCHELLA, *Ag.* Trigon. Monog., Plate XXXVIII, figs. 10—12; and Trigon. Supplement, Plate III, figs. 7—12.

The figures of this pretty little Liassic species (given Plate XXXVIII, figs. 10—12, page 185) are of small dimensions, and do not illustrate the shell in its more advanced condition of growth; I therefore gladly take the present opportunity to figure other and more suitable specimens; The two larger shells (Pl. III, figs. 10—12) exemplify the ultimate stage of growth and exhibit a considerable change in the ornamentation of the large area; it will be observed that the acute transverse costæ, which in immature forms are widely separated, become ultimately closely arranged and even crowded near to the siphonal border.

Specimens in my collection, showing the interiors of the valves, have three alternating prominences and pits near to the posteal extremity of the pallial border. It would appear that the specimens at the disposal of Agassiz did not exhibit the interiors of the valves, or no doubt he would gladly have figured and described these internal features; his specimens are only of median size; the larger single specimen figured by Quenstedt ('Der Jura,' plate xliv, fig. 1) was probably imperfect posteally, and so obtained the short truncated aspect which the species does not possess.

Position and Locality.—Trigonia pulchella has been collected at Lincoln, in the Upper Lias in the Zone of Ammonites communis, both by Mr. Keeping, of Cambridge, myself, and Mr. W. D. Carr; to the last I am indebted for the unusually fine specimens herewith depicted. I am not aware that the species has been obtained at any other British locality.

TRIGONIA MORETONI, *var.* OXONIENSIS, *Lycett.* Trigon. Supplement, Plate I, figs. 13—15.

The typical or Great-Oolite variety of *Trigonia Moretoni* has been sufficiently depicted in the Monograph on Plate II, figs. 4, 5, 7, 8, also Plate IV, fig. 6, and has been described pp. 47, 59, 63, 70, 78; it is there shown to be a very variable species even in the Great Oolite, and I have now to describe a distinct variety which has been obtained rather sparingly by Mr. Walford and by Mr. Windoes in the lower beds of the Inferior Oolite at Hook Norton, Oxon.

All the specimens of *Trigonia Moretoni*, var. *Oxoniensis*, obtained are smaller than the typical form, and differ from it in the following features: the entire ornamentation of shell is larger and bolder or more strongly defined; the concentric costæ are fringed with papillæ, from the pallial margin to the apex; they are remarkably prominent, regular, and concentric; their papillæ are also very large, rounded, and elevated; but even these costæ are not without variability, for, notwithstanding this regularity, some specimens have the costæ rather transverse than concentric, with little curvature. The area has its costellæ unusually elevated, and scarcely any two specimens have them alike; but the inner carina is always distinct, prominent, and spinose. The largest shells of this little variety are not more than six lines across the valve.

It may be a matter of doubt whether I am justified in placing this little species as a variety of *T. Moretoni*, it differs so considerably from the Great-Oolite forms; the limits of variability assumed by this species are in truth so considerable that I feel much diffidence in deciding upon differences with strata having a wide stratigraphical separation. Apparently the present specimens are not of adult growth, and the decision of this question may be relegated to a period when the number of known specimens shall have become more considerable, and the results of comparison more certain.

TRIGONIA FORMOSA, *Lycett.* Trigon. Monogr., Plate V, figs. 4, 5, 6; Plate XI, fig. 2; Plate XXXVII, fig. 10; var *lata*, Plate XXIX, figs. 11, 12; var. *lata*, Pl. XXXV, fig. 7; Trigon. Supplement, Plate I, figs. 11, 12.

I am induced to figure the two forms on Plate II, figs. 11 and 12, on account of the great concavity of the area and hinge-border: of these the Rev. Mr. Wiltshire has also sent me other fine specimens. The contrast afforded by these forms when compared with the *Trigonia striata* of Dorsetshire and Somersetshire is very striking, and fully justifies the separation I have made between that species and the *T. formosa* of the Cotteswolds. I do not, however, altogether perceive the necessity of erecting the present into a distinct

variety of *T. formosa*, as I think that some forms tending to connect them may be found in the specimens obtained by Mr. Witchell, which would reduce the distinction to individual peculiarities; they are, however, fully worthy of being figured and compared. I would also more especially direct the attention of foreign palæontologists to the figures of *T. formosa*, when no reliable British specimens can be obtained, as I have repeatedly been requested to show them the two species placed side by side for comparison. I am, however, quite satisfied with the figures of *T. striata* (Plate V, figs. 6′, 7, and 8), and would request them to compare the siphonal and hinge-borders of these three figures with the corresponding parts of *T. formosa*. I fear that fig. 6 (*T. formosa*) of Plate V has sometimes been mistaken for *T. striata* in mistake for 6′ of the same plate, which in its explanation is misprinted 3.

The figured specimens are from the Inferior Oolite near Stroud.

TRIGONIA GEMMATA, *Lycett.* Trigon. Monogr., Plate I, fig. 7; Trigon. Supplement, Plate II, fig. 6; var. *bifera*, Plate II, fig. 7.

The unusually well-preserved specimen of this rare little species herewith figured has been forwarded to me by Mr. Walford from the Hook Norton locality, where apparently it occupies a lower position in the Inferior Oolite (beds B and C) than in the Cotteswolds. The surface ornaments are minutely and delicately preserved.

Figure 7 on the same plate represents a specimen of the variety *bifera*, obtained by Mr. Witchell from the Inferior Oolite of Rodborough Hill, and described in a footnote, page 239. Mr. Witchell has also kindly forwarded to me other specimens of *T. gemmata* from the Clypeus-grit of the Stroud district; these, unfortunately, all imperfect, are chiefly remarkable for the minuteness of their ornamentation.

I have also discovered a specimen from the Dogger at Blue Wyke, North Yorkshire. In common with the fossils generally that crowd those beds in that locality, it is wanting in the delicacy of preservation which is often found in the fossils of Oxfordshire and of the Cotteswolds, and notably so in the Oxfordshire specimen here figured. I mention its occurrence on account of the geological position, which appears nearly to agree with that of the Oxfordshire form, and near the base of the Inferior Oolite; the Cotteswold examples, on the other hand, come from the highest beds of the formation.

TRIGONIA PRODUCTA, *Lycett.* Trigon. Monogr., Plate XIII, figs. 1, 2, 3, 4; and Plate XXXVII, figs. 1, 2; Trigon. Supplement, Plate II, figs. 4, 5.

The smallest of our figures (Suppl., Plate II, fig. 5), from the Clypeus-grit of the

Inferior Oolite of Rodborough Hill, is apparently a dwarfed specimen. Although only nine lines in length, it has formed seven transverse or oblique tuberculated costæ, and has commenced to develop the posteal ones. The specimen (fig. 4) from the Upper Trigonia-grit of the same locality is about half the adult size and has just commenced to develop the posteal costæ.

The present examples, together with those previously figured, will, I think, amply illustrate this large species, which is apparently more rare in the Cotteswolds than in Oxfordshire.

TRIGONIA ARDUENNA, var. *Rigaux* and *Sauvage* (not *Buvignier*). Trigon. Supplement, Plate I, fig. 6.

Descr. de quelques espèces nouvelles de l'Étage Bathonien du Bas-Boulonnais, par MM. E. Rigaux et W. Sauvage, Mém. de la Societé Académique de Boulogne, pl. iv, fig. 4, Dec., 1867.

I have no doubt that the fragment herewith figured from the Inferior Oolite of Hook Norton (beds B and C) is identical with the shell figured by Messrs. Rigaux and Sauvage from the Clypeus-grit of the Bas-Boulonnais, which they regard as a variety of the small species figured by Buvignier from the Oxfordian beds of the Ardennes. I decidedly object, however, to the identification of this with the Oxfordian species, to which I think it is only remotely allied; the latter is evidently a much smaller and more convex species with very numerous small anteal costæ, and therefore altogether distinct from the much larger and more flattened shell of the Inferior Oolite. It may be hoped that other and more satisfactory specimens will be obtained in Oxfordshire; but at present I can only figure the present fragment, which, although so imperfect, is highly characteristic, and I believe should be separated as a species from Buvignier's little shell.

TRIGONIA GUISEI, *Lycett.*, sp. nov. Trigon. Supplement, Plate III, figs. 1, 1 *a*, 2, 3, 3 *a*, 4, 5, 6.

Shell ovately oblong, lengthened, having considerable convexity anteally and mesially, depressed posteally; umbones large, recurved, antero-mesial, or placed within the anterior third of the valve; area much lengthened, narrow, flattened, bounded by two inconspicuous carinæ almost throughout its length; the marginal carina is entirely plain, the inner carina is minutely papillated; there is a small median furrow which on its outer side forms a narrow ridge. The escutcheon is much lengthened and excavated, forming

a lengthened and concave hinge-border; the siphonal border is comparatively short, placed almost at right angles with the hinge-border; the pallial border is lengthened and curved elliptically. The sides of the valves have very numerous small tuberculated costæ, at the umbonal extremity the first-formed three or four rows are subconcentric and plain, the succeeding rows become angulated with small irregular tubercles; the rows continue small near to the pallial border and are somewhat irregular in their direction; about the middle of the valve they are united to a much less numerous series of posteal costæ, which are also tuberculated. The posterior costæ are at first curved, but the succeeding ones become more perpendicular and are directed downwards from the marginal carina even to its posteal extremity. In adult forms the pallial costæ near to the border take nearly the direction of the lines of growth, and are small and crowded with minute fringing papillæ.

The general aspect of the ornamentation presents an approach to *Trigonia producta*, and is intermediate between that of *T. producta* and *T. angulata;* the curve of the uncompressed valve is, however, sufficiently distinct from either of those examples of the *Undulatæ* group and renders its separation as a species necessary. The distinctness of the species may, in fact, be recognised even in very young examples whenever they are well preserved, as well as in the apical portions of the more adult forms. I have therefore figured three of the smaller specimens collected by Mr. Walford and Mr. Windoes in Oxfordshire: the collection of Mr. Windoes contains two others of similar aspect, and also a much larger specimen apparently almost of adult growth. The surface ornaments are for the most part well preserved, but the posteal portion is too much truncated and imperfect to be submitted to the artist.

The largest of the Oxfordshire shells on our plate, figs. 3, 3 *a*, was obtained by Mr. Walford at Hook Norton in the lower beds of the formation. The surface ornaments are well preserved, but the specimen unfortunately is very imperfect posteally and is much flattened from vertical pressure. The acquisition of these specimens, together with the fine adult forms collected by Mr. Witchell in the Cotteswolds, has enabled me to discover and correct one of my own errors. The specimen attributed to *T. angulata* (Trigon. Monogr., Plate XIV, fig. 5) collected about twenty-five years ago in the Upper Trigonia-grit of Rodborough Hill, in its posteal portion is so defective and incomplete that I always entertained doubts of the correctness of that identification: the more recently obtained specimens in the Cottleswolds and in Oxfordshire enable me to separate this hitherto doubtful form from *T. angulata*, and to unite it to the present species, which is now well and sufficiently illustrated. The splendid and almost unique specimen from Mr. Witchell's collection (Trigon. Suppl., Plate III, figs. 1, 1 *a*) was obtained by him near the hamlet of Hyde in the parish of Minchinhampton in a whitish-grey limestone (Upper Trigonia-grit) and cleared by him after the employment of much skill and labour. The specimen obtained by Mr. Witchell (Plate III, fig. 2) from the Clypeus-grit of Rodborough Hill would also be considered a very fine specimen in the absence of the Hyde specimen, and proves

that the species occurs throughout the upper beds of the Inferior Oolite in the Cotteswolds.

Dimensions of the Hyde specimen. Length 3¼ inches; height 2¼ inches.

Dedicated respectfully to Sir W. V. Guise, Bart., F.L.S., F.G.S., of Elmore Court, now and for many years President of the Cotteswold Naturalists' Field Club, a position which he occupies with so much ability and benefit to its members.

TRIGONIA WALFORDI, *Lycett.* Sp. nov. Trigon. Supplement, Plate II, fig. 8.

Shell somewhat thick in the adult condition, ovately trigonal, moderately convex, umbones prominent, recurved; antero-mesial hinge-border comparatively short, obliquely sloping; siphonal border nearly as long as the hinge-border, its posteal extremity is somewhat produced and pointed; the pallial border is much lengthened, and curved elliptically throughout its length without angularity. The surface of the area is somewhat more raised than the other portion of the valve; it is comparatively narrow; its bounding carinæ are only slightly defined; it has the usual median furrow distinct throughout its length; its surface is inconspicuously striated transversely, excepting near to the apical extremity, where the bounding carinæ are distinct.

The surface has a few acute transverse costellæ, which are equal in size to the first-formed apical costæ, from which they are only separated by the minute carinal tubercles. The escutcheon is rather wide and flattened, having rugose, oblique plications of growth. The other and much the larger portion of the valve has the costæ numerous (about eighteen or nineteen), the few first-formed are narrow, closely arranged, and transverse or transversely concentric, those which succeed change in figure and acquire tubercles at their middle and posteal portions, so that at about the ninth costa the posteal portion of the row has short tubercular varices, which commence an upward flexure to the marginal carina; with each succeeding costa these tuberculated flexed varices rapidly enlarge, but with some irregularity, caused by the increasing prominence of the varices, so that the ornamentation then acquires an aspect confusedly and prominently nodulous over the middle and posteal portions of the valve; the costæ at the anteal portions continue narrow, rather acute, and attenuated even to their terminations at the pallial border, their number exceeding by two the posteal large flexed varices.

It will thus be seen that the costæ undergo changes in their figure and ornamentation throughout the entire growth of the shell, and that the general aspect of the surface would scarcely be known or appreciated if illustrated by examples of less mature growth, or less well preserved. Apparently the figured specimen is of adult growth, judging from the plicated aspect of the siphonal border, and from the costæ having almost ceased to form

the short posteal varices. Compared with the general aspect of the *Undulatæ*, the narrow lengthened figure and prominence of the nodose varices upon the middle and posteal portions of the valve constitute features which will not readily be mistaken for other of the Lower-Jurassic species, whether British or foreign.

Dimensions.—Length measured upon the marginal carina 28 lines; measurement at right angles to the carina 20 lines; convexity of a single valve about 6½ lines.

Position and Locality.—The specimen contributed by Mr. E. A. Walford was obtained from the Inferior Oolite of Oxfordshire, in the stratum above the Clypeus-grit, near Stow-on-the-Wold.

TRIGONIA WINDOESI, *Lycett.* Sp. nov. Trigon. Supplement, Plate I, figs. 7, 8, 9, 10

Shell in the very young condition much depressed, but acquiring a moderate convexity with advance of growth, ovately trigonal; umbones pointed, but little produced, antero-mesial, and slightly recurved; area large, flattened, divided by a median furrow and bounded by carinæ; of these the marginal carina is moderately elevated and plain, the inner carina is small, but is rendered serrated and rugose by the terminations of the transverse costellæ, which are plain, prominent, and become conspicuous as they approach the inner border of the area. The sides of the valves have a numerous series of plain, curved costæ (about thirteen), the first-formed five or six are simply curved and united posteriorly with the plain marginal carina; those which succeed enlarge and curve upwards at their posteal extremities, so that in the largest specimens the posteal portions of the costæ become oblique or nearly perpendicular varices, which are partially disunited from their anteal portions. There is much variability in the transverse costellæ upon the area, but usually they nearly disappear upon the area near to the siphonal border, which is oblique, but shorter than the hinge-border. The escutcheon is narrow, depressed, flattened, and inconspicuous. The entire plain marginal carina clearly separates the two portions of the valves, and is of itself sufficient to distinguish this little species from the *Trigonia cuspidata* of Sowerby, for which it has been mistaken; the latter is a minute, dwarfed, and very young form of a Great-Oolite species, probably *T. Moretoni.*

This small species has occurred rather sparingly in the lower beds of the Inferior Oolite at Hook Norton; the largest specimen has a length of 9 lines, the height being 7½ lines, and the convexity of a single valve 2½ lines.

This species belongs to the Angulatæ group, but with the general figure much shorter or subovate, and more depressed; the large area with its prominent costellæ is also very distinct; the smooth costæ are also quite destitute of tubercles. In the very young condition it might be taken for one of the *Costatæ.*

I take the name from Mr. J. Windoes, of Chipping Norton, who discovered and forwarded to me the present species, and is an ardent and energetic collector of the fossils of his locality; he has entrusted his collection to my care, and has supplied me with the following section of railway-cutting near Duckpool Farm, Hook Norton, giving the position of the present species, together with other testacea of the Inferior Oolite:

SECTION NEAR DUCKPOOL FARM, HOOK NORTON.

1. Flaggy limestone, with *Lima cardiiformis*, *Trigonia denticulata*, and *T. costata*.
2. Sand and rubbly limestone, with *Trigonia producta* and *T. costata*.
3. Pockets of sand and shells, yielding *Trigonia Windoesi*, Lyc., *T. Moretoni*, var. *Oxoniensis*, and T. *signata*, young specimen, *Pecten*, *Limæa*, *Limopsis*, *Cerithium*, *Chemnitzia*, all small shells. Soft sandy marl, four feet above Lias.
4. Upper-Lias Clay with *Leda ovum*, *Ammonites fibulatus*, *&c.* Floor of the cutting.

Thickness of Oolite 14 feet.

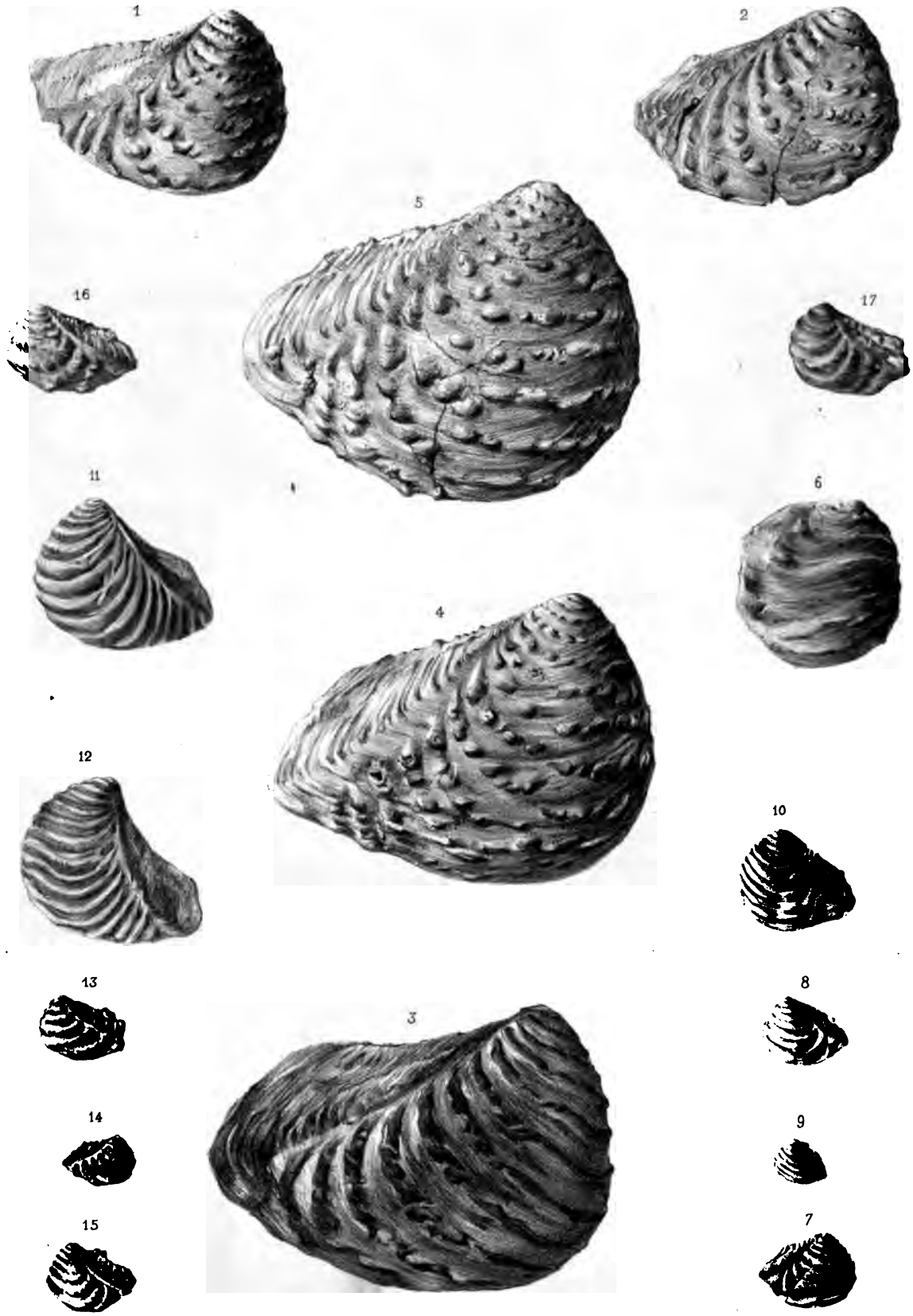
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SUPPLEMENT PLATE I.

FIG.	
1, 2.	*Trigonia signata*, var. *decurtata*, Lyc. Hook Norton. (Page 10.) Coll. of Mr. E. A. Walford, F.G.S.
3.	„ „ „ *Zietenii*, Lyc. Cloughton, Yorkshire. (Page 5.) My cabinet.
4, 5.	„ „ „ „ „ Near Rollright, Oxfordshire. Coll. Walford.
6.	„ *Arduenna*, var. Rig. and Sauv. Hook Norton, Oxfordshire. (Page 14.) Coll. Walford.
7, 8, 9, 10.	„ *Windoesi*, Lyc. Hook Norton. (Page 17.) 7, Coll. Walford; 8, 9, 10, Coll. of Mr. J. Windoes.
11, 12.	„ *formosa*, Lyc. Near Stroud. (Page 12.) Coll. of Mr. Witchell.
13, 14, 15.	„ *Moretoni*, Mor. and Lyc, var. *Oxoniensis*. Hook Norton. (Page 12.) 13, Coll. Walford; 14, 15, Coll. Windoes.
16.	„ *signata*, var. *Zietenii*, Lyc. Hook Norton. (Page 5.) Coll. Windoes.
17.	„ „ „ „ Rodborough Hill, Oxfordshire. Coll. Witchell.

All the specimens figured are from the Inferior Oolite.



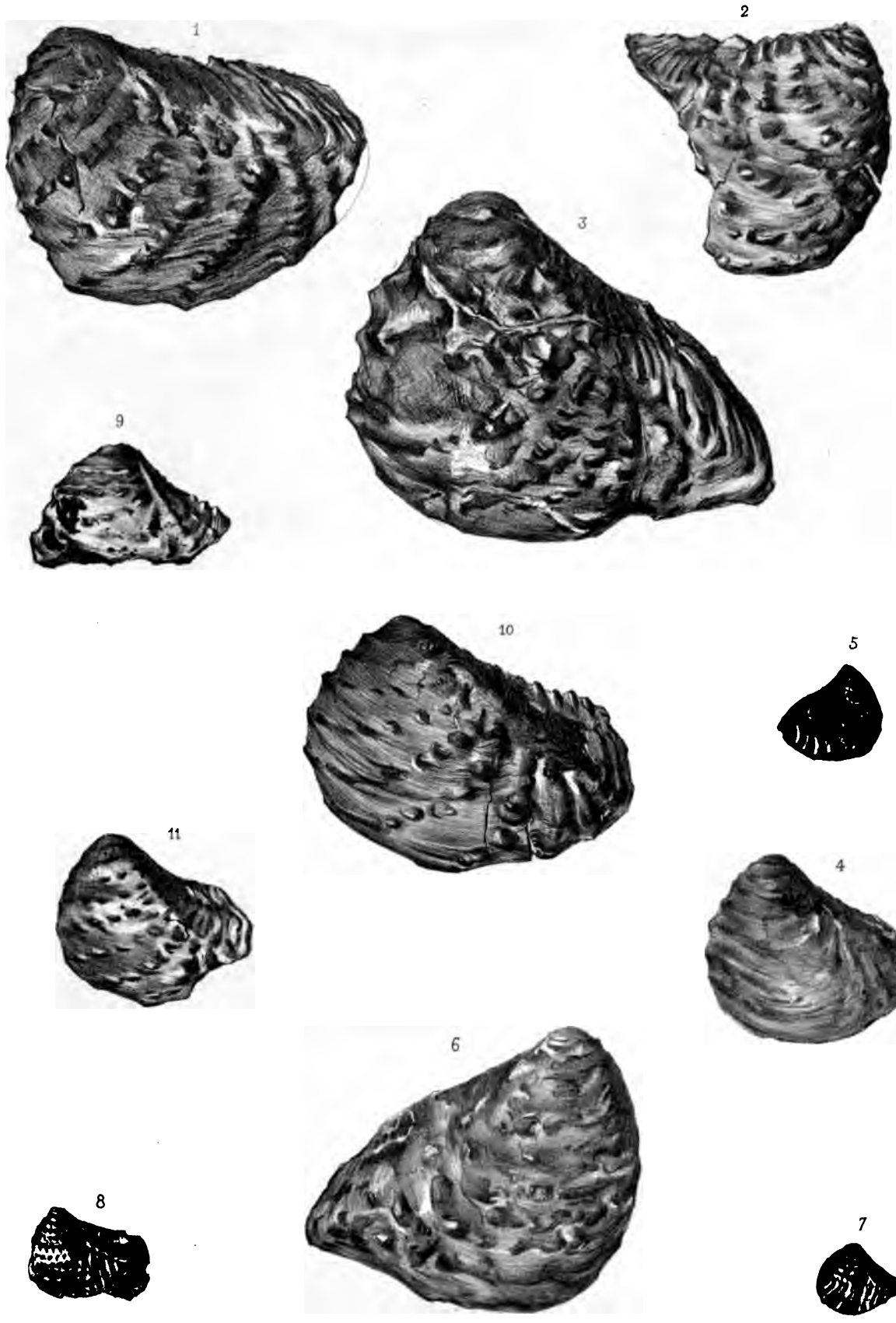
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SUPPLEMENT PLATE II.

FIG.		
1.	*Trigonia signata*, var. *rugulosa*, Lycett.	Cross Roads, near Over Norton. (Page 8.) Coll. Windoes.
2.	„ „ „	Cross Roads, near Over Norton. Coll. Walford.
3.	„ „ „	Cross Roads, near Over Norton. Coll. Walford.
4.	„ *producta*, Lycett.	Rodborough Hill. (Page 13.) Coll. Witchell.
5.	„ „	Young form, Rodborough Hill. Coll. Witchell.
6.	„ *gemmata*, Lycett.	Hook Norton. Coll. Walford. (Page 13.)
7.	„ „ var. *bifera*, Lycett.	Rodborough. (Page 13.) Coll. Witchell.
8.	„ *Walfordi*, Lycett. (Page 16.)	Above the Clypeus-grit near Stow-on-the-Wold. Coll. Walford.
9.	„ *signata* var *Stutterdi*, Lycett.	Hook Norton, Oxfordshire. (Page 9.) Coll. Walford.
10.	„	Hook Norton, Oxfordshire. Coll. Walford.
11.	„	Prior Farm, near Chipping Norton. Coll. Windoes.

All the specimens figured are from the Inferior Oolite.

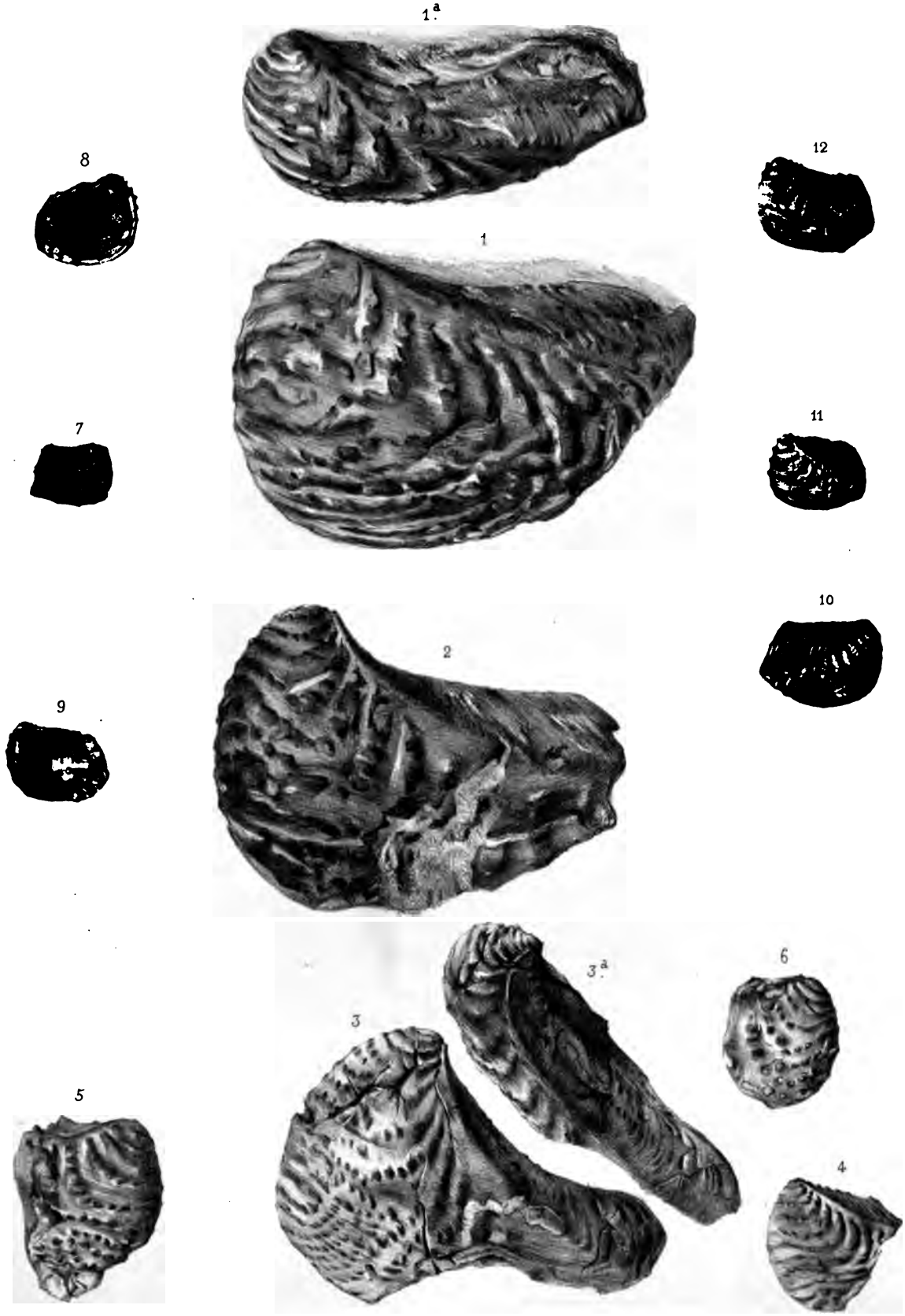


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SUPPLEMENT PLATE III.

FIG.			
1, 1*a*.	*Trigonia Guisei*, Lycett.	Inferior Oolite, near Minchinhampton. (Page 14.) Coll. Witchell.	
2	„ „	Inferior Oolite, Rodborough Hill. Coll. Witchell.	
3, 3 *a*.	„ „	Inferior Oolite, Hook Norton. Coll. Walford.	
4.	„ „	„ „ Coll. Windoes.	
5.	„ „	„ „ Coll. Walford.	
6.	„ „	„ „ „	
7, 8, 9, 10, 11, 12.	„ *pulchella*, Ag.	Upper Lias, zone of Ammonites communis. Lincoln. (Page 11.) My cabinet.	



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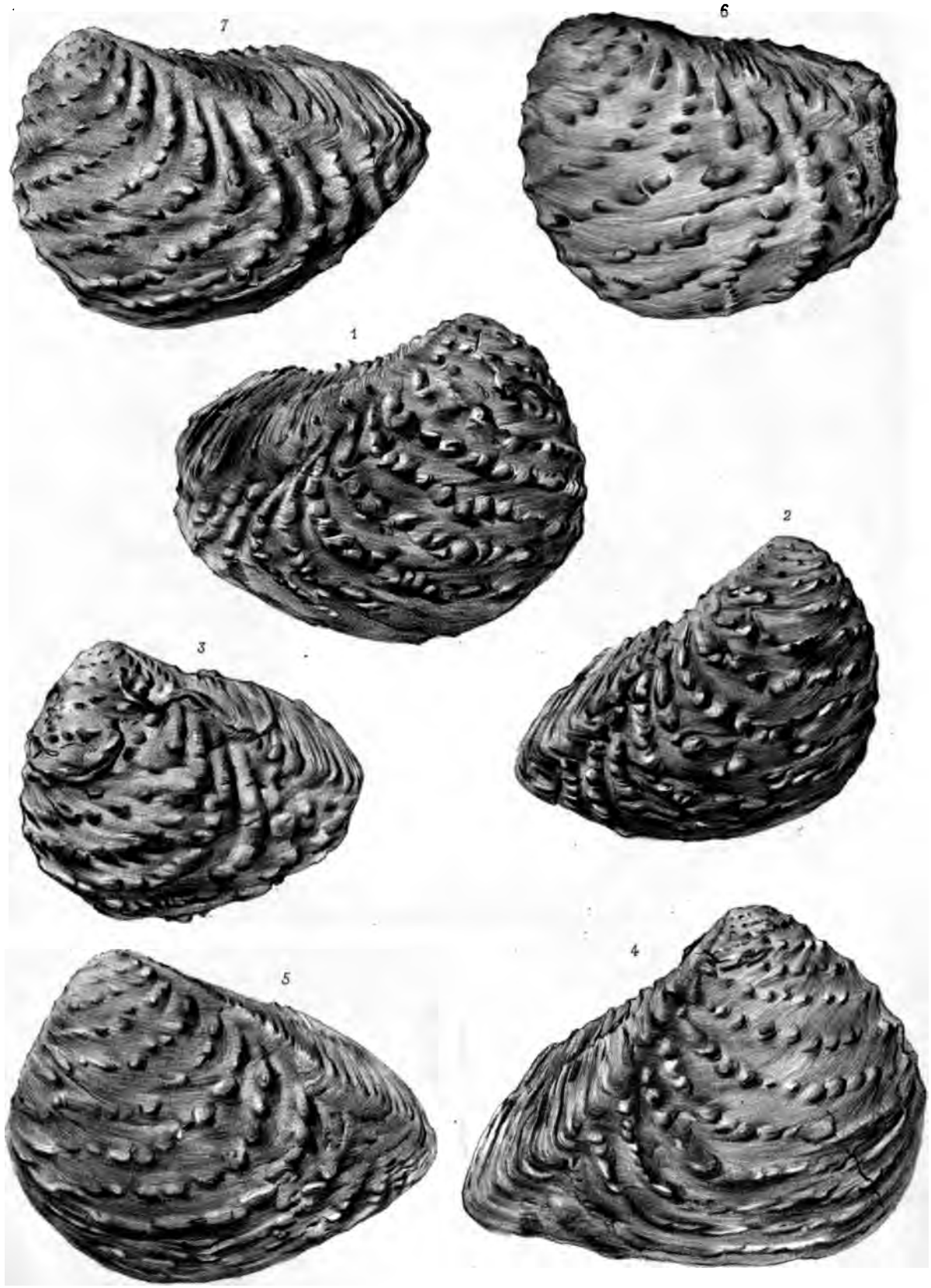
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SUPPLEMENT PLATE IV.

Plate IV, is intended to illustrate the Oxfordshire varieties of *Trigonia signata*, Ag. The figures have been selected from specimens liberally placed at my disposal by Mr. Stutterd, of Banbury, taken from his cabinet, and obtained by him at Rollright, near Chipping Norton; these, together with the examples figured upon Plates I and II, will sufficiently illustrate the four Oxfordshire varieties of *T. signata*.

FIG.		
1.	*Trigonia signata*, Ag., var. *Stutterdi*, Lyc.	A double valved specimen in the collection of Mr. Stutterd. (Page 9.)
5 and 6.	„ „	Two other specimens of the same variety. My cabinet.
2 and 4.	„ var. *rugulosa*, Lyc.	(Page 8.) My cabinet.
3.	„ var. *decurtata*, Lyc.	(Page 10.) My cabinet.
7.	„ var. *Zietenii*, Lyc.	(Page 5 .) My cabinet.

All the specimens figured are from the Inferior Oolite.



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